How efficient is the orienting of spatial attention to pain? An experimental investigation

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Abstract

We investigated how efficient spatial attention was oriented to pain in two experiments. Participants detected whether painful (pain group) or non-painful somatosensory stimuli (control group) were delivered to the left or right hand. Each stimulus was preceded by a visual cue presented near to the stimulated hand (valid trial), the opposite hand (invalid trial), or centrally between hands. In order to examine both exogenous and endogenous orienting of attention, the spatial predictability of somatosensory targets was manipulated. In the first experiment, visual cues were non-predictive for the location of the pain stimulus as a result of which orienting was purely exogenous, i.e., resulting from the occurrence of the visual cue at the location of somatosensory input. In the second experiment, visual cues were spatially predictive as a result of which endogenous control was added, i.e., attention driven by expectations where the somatosensory target will occur. The results showed that only in experiment 1 spatial attention was oriented more efficiently to painful compared to non-painful somatosensory stimulation. This effect was due to faster responses on valid relative to baseline trials (engagement), rather than slower responses on invalid relative to baseline trials (disengagement), and was significantly correlated with self-reported bodily threat. In experiment 2, prioritization of the pain location was probably overridden by task strategies, as it was advantageous for participants' task performance to attend to the cued location irrespective of whether stimulation was painful or not. Implications of these findings for theories of hypervigilance and attentional management of pain are discussed.

Keywords: Attention; orienting; bodily threat; experimental pain; cross-modal integration

Introduction

The ability to rapidly detect and respond to bodily threats such as pain is undoubtedly adaptive for survival [5,9,13]. Attention is believed to play a pivotal role in this ability, by amplifying behavioural and physiological responses to relevant information and attenuating responses to irrelevant information. There is indeed strong empirical evidence that pain is prioritized over competing information [5,17,40,43]. However, research on the role of spatial attention is scarce.

As the precise location of nociceptive input is particularly relevant for the rapid detection of bodily threats [11], one would assume spatial attention to be oriented highly efficiently to this location. It has recently been proposed that processing of nociceptive stimuli is supported by a multimodal brain system that detects and orients attention to stimuli signalling relevant changes in the proximal space surrounding the body [15,22]. More specific, it has been argued that nociceptive information is integrated with information from other senses, especially vision, to monitor potentially significant stimuli such as physical threats in the proximal space of the body [3,20].

The aim of this study was to investigate orienting of attention to the location of painful stimuli by visual cues. For this purpose we used a cross-modal spatial cueing paradigm [41]. Participants detected whether pain stimuli were delivered to the left or right hand. Each target stimulus was preceded by a visual cue presented near to the stimulated hand (valid trial), the opposite hand (invalid trial), or centrally between both hands (baseline trial). Attentional orienting is typically demonstrated by faster responses to valid compared to invalid trials, and can be decomposed into several components. Faster detection in valid relative to baseline trials reflects the benefits of engaging attention on the cued location, whereas slower detection in invalid relative

to baseline trials results from the costs of disengaging attention from the cued location and shifting to the other location [27,41].

Orienting of spatial attention to the location of pain by visual cues may be either exogenous (visual cue involuntarily captures attention by its appearance) or endogenous (visual cue is voluntarily attended because it is predictive for the pain location) [27]. We examined both forms of spatial orienting in two experiments in which the spatial predictability of somatosensory targets was different. In the first experiment, visual cues were non-predictive for the location of the pain stimulus (equal proportion of valid and invalid trials), as a result of which orienting was purely exogenous, i.e., resulting from the occurrence of the visual cue at the location of somatosensory input. In the second experiment, visual cues were spatially predictive (higher proportion of valid than invalid trials), as a result of which endogenous control was added, i.e., attention driven by expectations where the somatosensory target will occur.

In order to examine how efficiently attention was oriented to the location of pain, both experiments included a control group in which targets were non-painful somatosensory stimuli. We hypothesized that visual cues would orient spatial attention more efficiently in the pain group than in the control group.

Methods

Participants

Subjects in both experiments were undergraduate psychology students (experiment 1: N = 53, age = 18.55, 40 females, all white Caucasian; experiment 2: N = 50, age = 19.02, 48 females, all white Caucasian) from Ghent University who

participated to fulfil course requirements. Both experiments were approved by the local ethical committee. All participants gave informed consent and were free to terminate the experiment at any time. Each person had normal or corrected-to-normal eyesight. Experimental duration was approximately 30 minutes.

Experimental device

Figure 1 depicts a schematic representation of the experimental set-up, which is similar to previous work [38,41]. Participants sat in front of a table, which was equipped with a chin-rest to maintain the head in a median position. The forearms were positioned symmetrically on the table, both hands resting on a response button. About 10 cm above the table, a black 50 cm high curved screen was installed, on a distance of 36 cm from the participants' eyes. At the base of the screen three LEDs were attached: one central and two lateral (left and right) at approximately 27° from the middle. Participants stretched their arms beneath the screen in such a way that the wrists were exactly at the position of the left and right LED, and hands were not visible for the participants.

(Insert Figure 1)

Task and stimuli

The task was programmed and presented by the INQUISIT Millisecond software package. INQUISIT measures response times with millisecond accuracy [6]. The task consisted of the presentation of visual cues and somatic targets. Visual cues were LED's presented close to the left or right hand, or centrally between both hands. In the pain group, somatosensory targets were low-intense, unpleasant/painful electrocutaneous stimulus, delivered by a constant current

stimulator (Digitimer DS7A, 1998). These stimuli had a duration of 200ms, and consisted of trains of electrical pulses with a frequency of 65 Hz (pulse width: 2ms; number of pulses: 13; interval between pulses: 14ms), and were delivered at the external side of both wrists by pairs of lubricated Fukuda standard Ag/AgCl electrodes (1 cm diameter). The skin at the electrode sites was first abraded with a peeling cream (Nihon Kohden) in order to reduce skin resistance. Intensity of the electrocutaneous stimulus was 1.00 mA, with an instantaneous rise and fall time. In the control group, somatosensory targets were non-painful tactile stimuli, delivered by vibration elements attached to both wrists with a velcro. These element consisted of a Nokia 3210 vibramotor, enveloped by a plastic cylinder (1.3 cm in diameter and 3.0 cm long). Tactile stimuli had an instantaneous rise and fall time, and a duration of 200ms. In a previous study [37] using similar stimuli, it was found that this tactile stimulus is perceived as equally intense as, but significantly less aversive and threatening than the electrocutaneous stimulus.

Each test trial began with the presentation of the central LED (1000ms). Shortly (200ms) after offset, either the left, right, or (the same) central LED was activated for a duration of 200ms. This was immediately followed by a somatosensory stimulus to one of both wrists, which lasted 200ms. Participants were instructed to detect the target stimuli as quickly and accurately as possible, by pressing the corresponding response button (left versus right). A trial was completed when a participant responded or 1500ms had elapsed. After another 3000ms the next trial started. There were three types of trials: (1) target preceded by cue at same position (valid trial), (2) target preceded by cue at opposite position (invalid trial), and (3) cue presented centrally between both hand (baseline trial). The different trial types allowed the calculation of response time benefits of engaging attention to the

cued location and response time costs of disengaging from the cued location and shifting to the other location. In order to control for potential response biases (responses to the location of cues instead of targets), a number of catch trials were included, in which only a cue but no target was presented. Participants were explicitly instructed to respond only to target stimuli.

Procedure

First there was a preparation phase in which participants were informed about the task and the stimuli, were familiarized with the stimuli used, and gave their informed consent. In both experiments, participants were randomly allocated to the pain group and the non-pain group. In the pain group participants were informed that an electrocutaneous stimulus would be used and that this stimulus "*stimulates the pain fibres and that most people find this kind of stimulation unpleasant*". In the control group, participants were informed that a vibrotactile stimulus would be used, and that this stimulus "*stimulates the touch fibres and that most people find this kind of stimulation not unpleasant*". After this preparation phase, the experiment began with a short practice phase (experiment 1: 8 trials; experiment 2: 12 trials). Next, participants rated intensity, painfulness, and how fearful they were of the somatic stimuli on eleven-point numerical rating scales (anchored 0 = not at all and 10 = very strongly). Unpleasantness of the somatic stimuli was rated on an eleven-point numerical rating scale (anchored -5 = very unpleasant; +5 = very pleasant). Next, the experiment phase consisted of 48 trials in experiment 1 and 72 trials in experiment 2. Experiment 1 consisted of 12 valid trials, 12 invalid trials, 12 baseline trials, and 12 catch trials, as a result of which cues were spatially non-predictive. Experiment 2 consisted of 36 valid trials, 12 invalid trials, 12 baseline trials, and 12 catch trials, rendering cues spatially predictive.

In both experiments, participants completed the Dutch version of the Pain Catastrophizing Scale (PCS) [33] after completion of the experimental task. The PCS is a 13-item scale that measures the level of catastrophic thinking about pain. Participants are asked to reflect on past painful experiences and to indicate the degree to which they experienced each of the 13 thoughts or feelings during pain (e.g. 'I become afraid that the pain may get worse') on a 5-point scale from 0 (not at all) to 4 (all the time). The Dutch version of the PCS has been shown to be valid and reliable in both non-clinical and clinical populations [36]. The reliability (Cronbach's alpha) in this study was good (experiment 1: 0.85; experiment 2: 0.84).

Data analysis

In each experiment, mean reaction times were analysed using a 2 (Group: pain, control) x 3 (Cue: valid, invalid, baseline) ANOVA with repeated measures. Trials with errors and responses faster than 150 ms (anticipations) and slower than two standard deviations above the individual means for each trial type (misses) were removed from the analyses (< 5 % in both experiments). In order to follow-up significant interaction effects, 3 orienting indexes were calculated: a cue validity index ($RT_{invalid} - RT_{valid}$), an engagement index ($RT_{baseline} - RT_{valid}$), and a disengagement index ($RT_{invalid} - RT_{baseline}$). Cohen's *d* was calculated to determine whether results had a small (0.20), medium (0.50), or large (0.80) effect size [2]. Finally, correlations were calculated between all 3 indexes and both self-reported bodily threat and catastrophic thinking about pain (PCS). For self-reported bodily threat, a composite score was calculated using item scores on pain, fear, and unpleasantness (pain + fear - unpleasantness). The reliability (Cronbach's alpha) of this bodily threat index was good (experiment 1: 0.79; experiment 2: 0.83).

Results

Experiment 1

All self-report data are summarized in Table 1. As expected, the pain group reported significantly higher scores than the control group on painfulness ($F(1,51) = 29.78$, $p < .001$, $d = 1.48$ [95% CI: 0.88, 2.08]), unpleasantness ($F(1,51) = 54.83$, $p < .001$, $d = 2.02$ [95% CI: 1.36, 2.67]), fear ($F(1,51) = 28.94$, $p < .001$, $d = 1.46$ [95% CI: 0.86, 2.06]), and the composite bodily threat index ($F(1,51) = 71.04$, $p < .001$, $d = 2.28$ [95% CI: 1.60, 2.96]). No significant group differences were found on perceived stimulus intensity ($F(1,51) = 1.54$, $p > .10$; $d = 0.34$ [95% CI: -0.20, 0.87]) and PCS ($F < 1$; $d = 0.09$ [95% CI: -0.44, 0.62]).

(Insert Table 1)

Mean reaction times (RT) per trial type are summarized in Table 1. The average number of responses to catch trials was very low (1.3%). Reaction times on catch trials were not further analysed. The 2 x 3 ANOVA revealed a significant main effect of Cue ($F(2,102) = 26.38$, $p < .001$). This was however qualified by a significant Group x Cue interaction effect ($F(2,102) = 3.66$, $p < .05$), indicating that the type of somatosensory stimulus modulated spatial cueing effects. In the pain group, post-hoc comparisons showed that responses were significantly faster on valid trials than on invalid trials ($t(25) = 4.81$, $p < .001$). In comparison with baseline trials, responses were significantly faster in valid trials ($t(25) = 5.61$, $p < .001$) but not significantly slower in invalid trials ($t(25) = 1.67$, $p > .10$). In the control group, a similar pattern was found. Responses were significantly faster on valid trials than on invalid trials ($t(26) = 4.53$, $p < .001$). In comparison with baseline trials, responses were

significantly faster in valid trials ($t(26) = 2.99$, $p < .01$) but not significantly slower in invalid trials ($t(26) = 1.44$, $p > .10$). In order to detect differences between groups in spatial orienting, between-subjects ANOVA's on the separate cueing indexes (see Figure 2) were performed. We found that both the cue validity index ($F(1,51) = 5.23$, $p < .05$, $d = 0.62$ [95% CI: 0.08, 1.17]) and the engagement index ($F(1,51) = 7.56$, $p < .01$, $d = 0.75$ [95% CI: 0.20, 1.30]) were significantly larger in the pain group than in the control group. There was, however, no group effect on the disengagement index ($F < 1$, $d = 0.12$ [95% CI: -0.41, 0.65]). Further, we found significant positive correlations (see Table 2) between self-reported bodily threat and both the cue validity index and the engagement index, but not with the disengagement index. The PCS did not significantly correlate with any of the RT indexes.

(Insert Figure 2)

(Insert Table 2)

Experiment 2

All self-report data are summarized in Table 1. As expected, the pain group reported significantly higher scores than the control group on painfulness ($F(1,48) = 17.87$, $p < .001$, $d = 1.18$ [95% CI: 0.58, 1.77]), unpleasantness ($F(1,48) = 50.70$, $p < .001$, $d = 1.93$; [95% CI: 1.27, 2.59]), fear ($F(1,48) = 9.39$, $p < .005$, $d = 0.85$ [95% CI: 0.28, 1.42]), and the composite bodily threat index ($F(1,48) = 33.13$, $p < .001$, $d = 1.60$ [95% CI: 0.98, 2.23]). No significant group differences were found on perceived stimulus intensity ($F < 1$; $d = 0.18$ [95% CI: -0.36, 0.73]) and PCS ($F < 1$; $d = 0.14$; [95% CI: -0.41, 0.68]).

Mean reaction times (RT) per trial type are summarized in Table 1. The average number of responses to catch trials was very low (1.2%). Reaction times on catch trials were not further analysed. The 2 x 3 ANOVA revealed a significant effect of Cue ($F(2,96) = 99.62$, $p < .001$). There was no significant interaction with Group ($F < 1$), indicating that painfulness of the stimuli did not modulate spatial cueing effects. In the pain group, post-hoc comparisons showed that responses were significantly faster on valid trials than on invalid trials ($t(24) = 9.90$, $p < .001$). In comparison with baseline trials, responses were significantly faster in valid trials ($t(24) = 7.25$, $p < .001$) and significantly slower in invalid trials ($t(24) = 3.83$, $p = .001$). In the control group, a similar pattern was found. Responses were significantly faster on valid trials than on invalid trials ($t(24) = 9.72$, $p < .001$). In comparison with baseline trials, responses were significantly faster in valid trials ($t(24) = 5.99$, $p < .001$) and significantly slower in invalid trials ($t(24) = 4.00$, $p = .001$). Between-subjects ANOVA's showed no significant differences between the pain group and the control group in the cue validity index ($F(1,48) = 1.19$, $d = 0.29$ [95% CI: -0.26, 0.84]), the engagement index ($F < 1$, $d = 0.07$ [95% CI: -0.48, 0.61]), and the disengagement index ($F < 1$, $d = 0.23$ [95% CI: -0.32, 0.78]). No significant correlations between the orienting indexes and self-reported bodily threat and PCS were found (see Table 2).

Discussion

In this study we investigated orienting of spatial attention to painful and non-painful somatosensory stimuli. We found that both painful and non-painful somatosensory stimuli were faster detected when a visual cue was presented near to the stimulated hand than when it was presented near to the opposite hand. Of particular interest, whether orienting of spatial attention to a somatosensory stimulus

was modulated by its painfulness depended on the spatial predictability of somatosensory targets. In experiment 1, where visual cues were non-predictive for the location of somatosensory targets, orienting of attention was more pronounced in the pain group than in the control group. This effect was due to stronger engagement of attention to the cued location (faster detection of somatosensory targets in valid compared to baseline trials), and was significantly correlated with self-reported bodily threat. In experiment 2, where visual cues were predictive for the location of somatosensory targets, orienting of attention to the location of somatosensory input was not modulated by its painfulness.

The finding that processing of pain is influenced by vision, confirms that nociception is integrated with information from other senses, especially vision, in order to form a global representation of the body and the space nearby, and to monitor potential physical threats [15,21,22]. Such peripersonal representation of space [28] has been documented for interaction between vision, proprioception and innocuous haptic senses [18,20,30,31]. One of the main functions of this crossmodal interaction is to provide coordinating frames about the position of objects in the surrounding environment with respect to the body [12]. Such information might be particularly important in maintaining the physical integrity of the body and in avoiding tissue damage. For instance, it might serve the planning and execution of actions aimed at protecting the body from physical threats [3]. From that perspective, it makes sense that visual information near to the body facilitates somatosensory processing at the corresponding location even more in a context of bodily threat. For example, it has been demonstrated that pictures suggesting physical threat close to one of the hands facilitated processing of tactile stimuli to that hand compared to the other hand [26,39].

Interestingly, spatial orienting was modulated by painfulness and bodily threat in the first but not in the second experiment. Because in experiment 1 visual cues were non-predictive for the location of somatosensory targets, orienting of spatial attention was exogenous, meaning that it relies only on the occurrence of the visual cue at the location of somatosensory input. Because cues were spatially uninformative for targets, it was not advantageous for participants' task performance to engage attention on their location. However, in the pain group, visual cues were highly valid temporal predictors of painful stimulation, and therefore rapid engagement of attention to these cues is particularly effective. One might even speculate that in such context of bodily threat, orienting of spatial attention did not rely solely on bottom-up mechanisms, but was at least partially top-down controlled by the task-unrelated goal to monitor potential threats to the body [17,40]. The fact that this engagement of attention was even more pronounced in those participants reporting the strongest experience of bodily threat further supports this idea [37,38]. From that perspective it is perhaps a bit surprising that spatial orienting was not modulated by the disposition to experience catastrophic thoughts about pain. However, this might be due to the lack of correspondence between the experimental pain experienced here and the types of pain described in the PCS [33] that was used to assess catastrophic thinking.

In experiment 2, visual cues were spatially informative, as a result of which orienting was also supported by endogenous or goal-directed control, i.e., driven by advance knowledge concerning where the somatosensory target was expected to occur [27,31]. Here, the presentation of a visual cue signalled the likely occurrence of a somatosensory target stimulus at the cued location. As a result, it was advantageous for participants' task performance to engage attention of the cued

location, irrespective of whether the somatosensory stimulus was painful or not. This is also in line with cognitive psychology theories on task- and goal-directed behaviour, stating that sensory information is prioritized as a function of its relevance to current goals [4,14,44]. This prioritization occurs by means of top-down attentional control settings induced by the task goal [10,42]. Still one might have expected attentional engagement with the cued location to be more pronounced in the pain group than in the control group, given the higher relevance of temporally predictive cues in a context of bodily threat, as in the first experiment. The fact that this was not the case in experiment 2 is probably due to an overriding effect of task strategy: spatial orienting was already maximized by task-related top-down attention to the cued location, as a result of which modulation by painfulness or bodily threat was not possible. This becomes evident when inspecting the magnitude of the spatial orienting effects (cue validity index) in the control group, which was substantially larger in experiment 2 (59ms) compared to experiment 1 (28ms). Similar results were reported by Dowman [7,8], who induced endogenous orienting of attention to the location of somatosensory stimuli by means of symbolic cues (letter “L” or “R”) signalling the likely location of stimuli, and found no modulation by the painfulness of somatosensory stimuli. However, note that with the cue-target interval used in our study (i.e., 200ms), both endogenous and exogenous attention may be in operation, and that in order to clearly distinguish their effects or to identify purely endogenous effects, a larger cue-target interval may be needed.

The comparison of reaction times on valid and invalid trials with reaction times on baseline trials allows specific interpretation of spatial orienting effects as benefits of engaging attention on the cued location (engagement index) and/or costs of disengaging attention from the cued location and shifting to the other location

(disengagement index). In the first experiment, we found that the engagement index, but not the disengagement index, was significantly larger in the pain group than in the control group. This indicates that stronger orienting of spatial attention to threatening compared to non-threatening somatosensory stimuli is particularly the result of visual information facilitating somatic processing at the corresponding location rather than attenuated somatic processing at the other location. This beneficial effect of pain-relevant spatially valid visual cues is obviously advantageous, allowing rapid detection and efficient processing of potential bodily threat. Despite increased engagement of attention to the cued location in the pain group, this was not associated with attenuated somatosensory detection by spatially invalid visual cues. Apparently, participants were still able to disengage attention from the cued location and shift it to the location. This is not surprising, because slower processing of painful relative to non-painful somatosensory input to an unattended location of the body would prove maladaptive from an evolutionary perspective. Apparently the attention system is sufficiently flexible to detect and respond to bodily threats when spatially invalid visual information is provided [16]. In such situation, one might even expect facilitated shifting to bodily threat, i.e., a smaller disengagement index in the pain group than in the control group [9]. However, such facilitated shifting was not found (see also [8]). One reason might be the fixed time interval between visual cues and somatic targets, resulting in high temporal predictability: when the visual cue was not immediately followed by a somatic stimulus at the corresponding location, participants automatically knew they had to rapidly shift attention to the other location, regardless whether the target stimulus was painful or not.

An interesting question is whether the reaction time benefits observed here reflect faster perception and/or faster response execution. Our paradigm does not allow differentiating between purely perceptual and motor preparation effects. Indeed, as left-right categorizations were made by means of responses with the left and the right hand, cueing effects might be due to both improved perception of somatosensory input at the cued location relative to the uncued location, as well as to increased motor preparation of the cued hand relative to the other hand. More research is needed replicating the present findings using paradigms allowing differentiation between perceptual and motor response processes. However, note that cross-modal cueing studies controlling for such cue-response priming effects were still able to demonstrate reaction time benefits to tactile stimuli by spatially valid visual cues [32]. Furthermore, research using imaging techniques suggests that the brain possesses a number of hetero-modal areas that receive convergent input from different sensory systems [35], and that multimodal integration is already possible at early stages of information processing [1,34].

The involvement of multimodal integration in the orienting of attention to bodily threat has implications for current theories on hypervigilance (excessive attention to pain-related signals) in chronic pain [5,29]. Research on pain-related hypervigilance has studied attentional orienting mainly in separate modalities, either vision [23,37] or somatosensation [24]. The present work suggests that cross-modal interactions should be taken into account in order to fully understand the phenomenon of hypervigilance. Furthermore, the finding that bodily threat facilitates orienting of spatial attention to multisensory events may help further refining the use of distraction techniques in the context of aversive medical procedures, for example by distorting the view of the stimulated body part [19] or by crossing the arms [11].

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Summary

Visual cues orient spatial attention more efficiently to painful compared to non-painful stimuli but this effect can be overridden by task strategies.

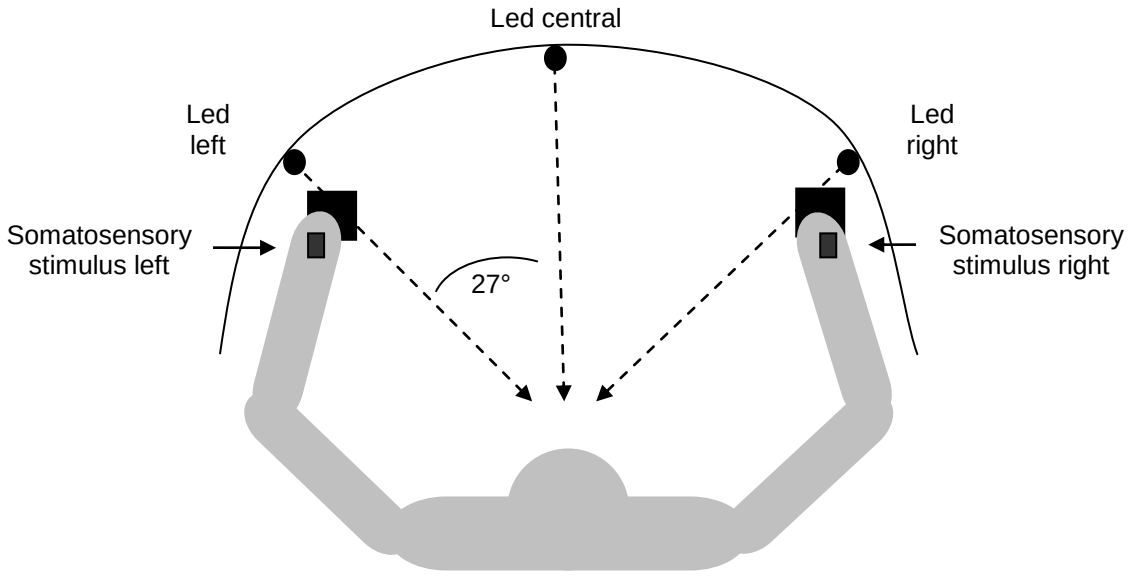
Figure legends

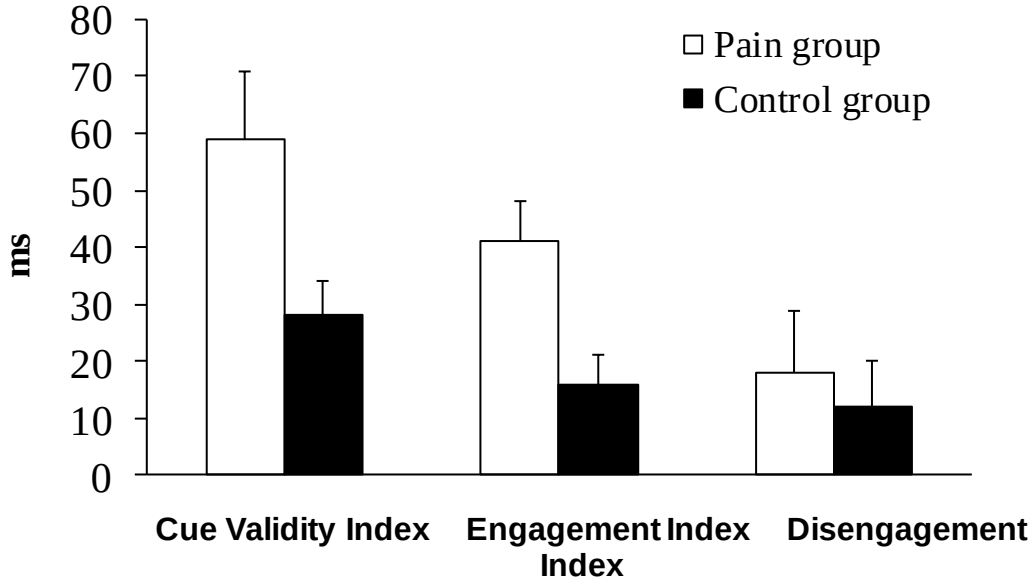
Figure 1. Schematic representation of experimental set-up.

The picture shows the position of participants in relation to the visual cues, somatosensory targets and response buttons.

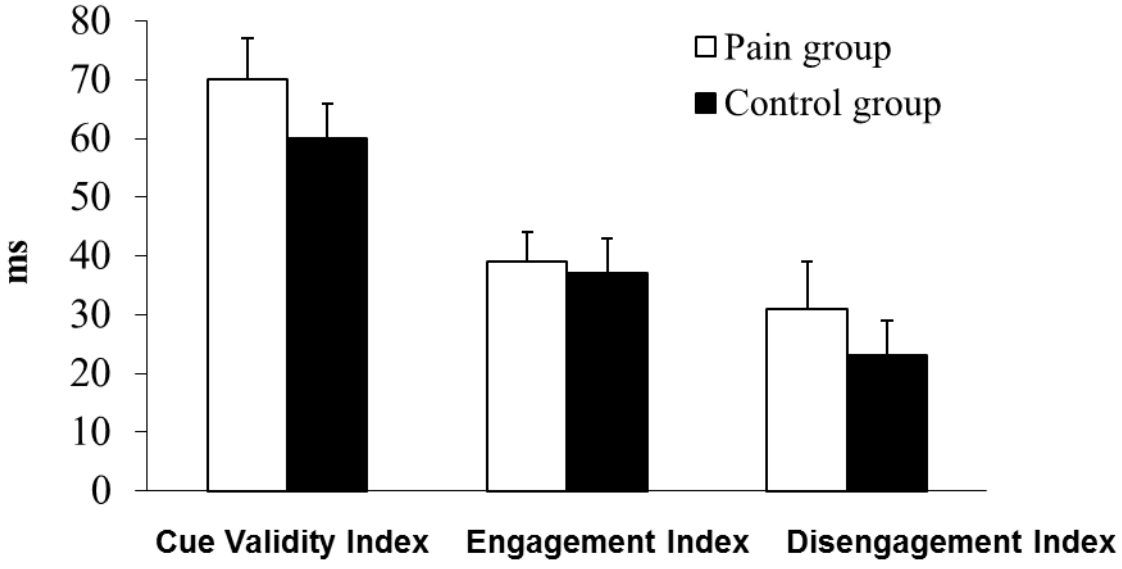
Figure 2. Orienting indexes in pain and control groups.

The graph shows the mean cue validity index, engagement index, and disengagement index (with standard errors) in the pain and the non-pain group in experiment 1 (panel A) and experiment 2 (panel B). A positive cue validity index (RT invalid – RT valid) indicates that the detection of somatosensory stimuli was faster when the stimulated hand was cued than when the other hand was cued. A positive engagement index (RT baseline – RT valid) indicates that the detection of somatosensory stimuli was faster when the stimulated hand was cued than when no hand was cued. A positive disengagement index (RT invalid – RT baseline) indicates that the detection of somatosensory stimuli was slower when the non-stimulated hand was cued than when no hand was cued.


Led central
Led
left
Led
right
Somatosensory
stimulus left
Somatosensory
stimulus right
27°



Panel A



Panel B

Table 1. Means and standard deviations of self-report and RT data of different groups

	Experiment 1 (N = 53)		Experiment 2 (N = 50)	
	Pain group (N = 26)	Control group (N = 27)	Pain group (N = 25)	Control group (N = 25)
PCS	19.58 (8.14)	18.93 (6.56)	19.04 (7.16)	20.04 (7.07)
Intensity	4.00 (1.72)	4.63 (1.96)	3.80 (1.73)	4.12 (1.69)
Unpleasantness	-1.58 (1.30)	1.33 (1.54)	-1.84 (1.49)	1.20 (1.53)
Pain	1.85 (1.67)	0.07 (0.27)	2.12 (2.01)	0.28 (0.84)
Fear	2.96 (2.73)	0.11 (0.32)	2.16 (2.29)	0.56 (1.26)
Bodily threat	6.38 (4.35)	1.15 (1.61)	6.12 (4.82)	-0.36 (2.90)
RT Valid	489 (138)	513 (116)	396 (133)	417 (80)
RT Baseline	530 (128)	529 (114)	435 (133)	454 (80)
RT Invalid	548 (155)	541 (114)	466 (131)	476 (80)

Table 2. Pearson correlation coefficients between RT indexes and self-reports

	Experiment 1		Experiment 2	
	Bodily threat	PCS	Bodily threat	PCS
Cue validity index	.43*	-.05	.07	.07
Cue benefit index	.40*	-.07	..00	.17
Cue cost index	.16	.00	.07	.21

* $p < .005$